Author(s):	Ala-Fossi, Marko
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MARKO ALA-FOSSI

10. Digital Divergence of Terrestrial Broadcasting Systems in Europe

Although the European Union's official target date for digital switchover of broadcasting in 2012 is approaching, analogue broadcasting is not in immediate danger of extinction in Europe. This is mostly because the EU digital switchover plan does not apply at all to radio. The most paradoxical case is perhaps Finland, which was among the very first to switch off analogue television in 2007, but currently has no intention to implement digital radio. Originally, in the 1980s, radio was supposed to be the first mass media worldwide to go digital using the new European technology with mobile multimedia capabilities for Digital Audio Broadcasting (DAB). Research for digital radio also provided the technological basis for Digital Video Broadcasting (DVB) when the development of digital television in Europe began seriously, following an American breakthrough in the 1990s. A new European system for mobile television (DVB-H) was developed after Japan had introduced its digital broadcasting system with mobile television services. This chapter seeks to examine the development of these digital terrestrial broadcasting systems from the perspective of the political economy (Mosco 1996). It studies the intermedial and international

relations between radio and television technology development projects in Europe, the US and Japan in the context of socio-political change shaped by neoliberalist policies and the marketisation of broadcasting during the last 30 years.

Besides being reactive rather than proactive and not truly comprehensive, the European project for digitalisation of broadcasting has not resulted in any significant convergence between broadcast media. Instead, if we take into account all existing and, for the most part, incompatible European broadcasting systems for terrestrial digital radio, mobile multimedia and television with their latest update versions, the number is closer to ten – and the situation becomes even more complicated if the rivalling systems from the US and Japan are also included. However, after a historical analysis, this is actually not surprising. The policies and politics for developing new digital broadcasting technologies were driven by strong economic motives from the very beginning, but not by intentions for any digital media convergence. Broadcasters in Europe – and everywhere else – were more interested in maintaining the existing structures than merging mediums together.

DVB digital television can be considered as the only relatively successful part of the European broadcast digitalisation project, especially when compared with the development of DAB digital radio (Iosifidis 2011, O'Neill et al. 2010). This is largely due to the so-called *digital television paradox* (Galperin 2004): both national governments and international organisations have in many ways heavily promoted the migration to digital television despite the simultaneous ideological, legal and regulatory transition from political to more market-driven solutions in order to ensure certain vital political and economic interests. Consequently, although these two major European digital broadcasting standards were meant to be complementary, digital radio had in every aspect less to offer than digital television, and DVB clearly defeated DAB in an intermedial competition over political support and available economic resources.

In other words, the idea of digital media convergence between 'radio bits' and 'TV bits' (Negroponte 1995: 54) was primarily just an afterthought within digital broadcasting system development. As a result of continuing divergence between broadcast media, most radio is still analogue, and DAB 'has drifted to today's inertia' (Kroes 2011). In a truly converged broadcasting landscape, only one digital switchover would have been enough.

High-tech rivalry with better analogue TV – and digital radio

The basis for profound socio-political changes reshaping European broadcasting was laid in the early 1970s, when the so-called 'golden age of capitalism' turned into 'the Long Downturn', a long-term decline of industrialised capitalist economies after the oil crisis. Earlier Keynesian fiscal and monetary policies based on the state interventions into the market did not work against stagflation, and the governments were forced to seek new ways to fight the economic crisis. By the end of the decade, when the conservative governments of Reagan in the US and Thatcher in the UK came to power, the neoliberalist approach of reducing both public spending and government control over the markets had become the new dominant economic policy paradigm of the advanced capitalist world (Harvey 2005: 18–34, Hesmondhalgh 2007: 82–86).

Germany and some other European countries like Finland had adopted FM broadcasting on a large scale as early as the 1950s, but in the US and Japan, FM radio did not become commercially significant until the late 1960s. By that time, the worldwide sales of Japanese Hi-fi sound equipment with new FM Stereo radio tuners were booming, but television manufacturing in Japan was clearly in need of a new competitive edge against even cheaper East-Asian production. Like practically all national public service broadcasters at that time, Japanese NHK had – and still has – a technical research laboratory, which was

striving to improve the quality of the delivery as well as the availability of public broadcasting services. The NHK engineers had not been satisfied with the picture quality of the American NTSC colour television during the Tokyo Olympics, so they started to develop a visual equivalent to Hi-fi sound: Hi-Vision – an analogue system for High Definition Television (HDTV). This was exactly what the major Japanese electronics manufacturers were looking for, so they formed a national coalition with NHK for developing HDTV in 1970 (Ala-Fossi 2005: 100,149, Curwen 1994: 17, Hart 2004: 84).

In Europe, the BBC R&D department was already more interested in expanding analogue services with digital systems. The BBC was able to develop the first digital audio system for relaying programme feed between transmitters in the early 1970s. A few years later, the BBC introduced a new textual data extension to analogue television – Teletext – and took part within the European Broadcasting Union (EBU) in the pre-development for textual services in analogue FM radio using 'VHF radio data', later know as Radio Data System (RDS). Further BBC technical research during the 1980s resulted in NICAM, a digital stereo broadcasting system for television sound, which, however, was suited only for fixed reception. The new digital additions were well in line with the public service organisation and ideology: they did not blur established boundaries between radio and television but provided new or better quality information services for the public, free of additional charge (Ely and Eng 1981, Lax 2010: 77, Ala-Fossi 2010: 45–46). However, implementing these new services for the public also required close co-operation with electronics manufacturers.

In the US, national public service broadcasting had been only recently (1967) established, and the formerly mighty developers of broadcast technology, Radio Corporation of America (RCA) and Columbia Broadcasting System (CBS), had severely declined since their glory days. It is perhaps illustrative that American companies had made several efforts since the 1960s to introduce an analogue home video system, but the VHS system of JVC from Japan defeated all its rivals in the US market by the late 1970s – and, within a few years,

everywhere else as well (Liebowitz and Margolis 1995, Abramson 2003: 212–216). The biggest surviving losers, Sony (Betamax/Japan) and Philips (VCR/the Netherlands), decided to join forces in developing a new digital format for audio recordings, later known as Compact Disc (CD). The new standard was introduced in 1980, although the first commercial audio recordings were not released until 1982 (Soramäki 1990: 76, Immink 1998). The rare Euro-Japanese CD project had a fortunate timing because, by the early 1980s, Japan was more commonly seen in the Western world as a threat rather than a companion (O'Connor 2009).

Interestingly enough, the original initiative for developing a new digital radio system did not come from the electronics industries looking for new markets, but again from public service broadcasters. All the new digital extensions of analogue broadcasting – and especially the possibilities created by the new CD records – obviously inspired the technical research department of German public service broadcasters, Institut für Rundfunktechnik (IRT). In 1981, they began pre-development of a digital broadcasting system that could also deliver the pure new digital sound in mobile reception better than FM. IRT was primarily working on audio bit-rate reduction, while at the same time in France, the Centre Commun d'Études de Télévision et Télécommunications (CCETT), a joint organisation of the French public service broadcaster (ORTF) and the national research centre in telecommunications, was developing a completely new digital multicarrier transmission system (OFDM). By the mid-1980s, these two organisations had created together what Gandy (2003) calls 'the embryo' of digital audio broadcasting, though they were still far away from a functional digital radio system (O'Neill 2010: 32, Gandy 2003, Schulze and Lüders 2005, Immonen 1999).

After the first public tests with the new Hi-Vision system in the early 1980s, NHK had modified its original design to match better with American requirements. So in April 1985, the US Department of State decided to support the NHK proposal for HDTV as the world standard. For American broadcasters, wide-band HDTV was a

good excuse to keep mobile radio communications out of the vacant broadcast channels – and there was not much domestic TV manufacturing left to protect, while a single global TV standard was seen as a benefit for the US movie industry (Hart 1994: 215, Brinkley 1998: 16–19, Hart 2004: 196, Alvarez et al. 1999). However, the fear of NHK's commercial allies both from Japan and the US made the European Commission (EC) and other European stakeholders like national broadcasters oppose the NHK initiative and suggest a different approach at the meeting of the Consultative Committee of International Radio (CCIR) in May 1986. EUREKA, the new pan-European organisation for research and development coordination established by 17 European states and the EC, proved to be a useful tool in this neomercantilist project for defending European electronics industries against the Japanese Hi-Vision. The development project (Eureka 95) for the European version of HDTV was launched in July 1986 as one of the largest strategic projects of the new consortium. Major European electronics manufacturers, such as the French state-owned Thomson, Germany's Bosch Group, and the main coordinator, Philips, were centrally involved in the project along with the technical research organisations of several European public service broadcasters and the EBU (Sandholtz 1992, Hart 2004: 126–127, Soramäki and Okkonen 1999: 29–30, Evain 1995: 39).

Only six months later, the same three major European manufacturers were joined by the BBC, IRT and CCETT to launch another Eureka project (Eureka 147), this time coordinated by the German Space Agency (DLR). The development project of a Digital Audio Broadcasting (DAB) system was, without any doubt, another part of the European counterattack (Ala-Fossi 2010: 46, Evain 1995: 39). The original Eureka project form even states that 'the drawing up of a new digital audio broadcasting standard will therefore provide a long term counterbalance to the increasing dominance of the countries of the Far East in the consumer electronics sector'. When envisioning the additional data and multimedia transmission capabilities of DAB technology, it also refers to the concept of 'integrated services digital

broadcasting' (ISDB), an idea of a multipurpose digital broadcasting system drafted at NHK in the early 1980s. However, the original main focus in DAB development was not to enhance radio with multimedia, but to create a digital replacement technology for FM radio with superb sound and robust mobile reception (Yoshino 2000, Eureka 1986, O'Neill 2009).

It seems that, in the 1980s, the future of European broadcasting was seen as strictly media-specific and even divergent. Although radio was supposed to be the first mass media to go digital, the future of television was still thought to be not only separate, but also analogue. The HDTV systems of the 1980s are often presented as direct precursors to digital television, but both Hi-Vision and European HD-MAC (Multiplexed Analogue Components) were basically just advanced analogue television systems, as their names suggest. Both systems, however, complemented analogue HD video with digital sound, in the same way as ordinary analogue TV in Europe was already using digital NICAM stereo. It should also be noted that the HD-MAC was designed to be a swift counter-proposition to block the Japanese initiative. At that time in the late 1980s, developing a completely digital television system was still seen primarily as a theoretical option for the future, which is why it could not have been seriously considered as a useful short-term defence strategy.

The unexpected end of the analogue future

The concept of an 'information society' (*johoka shakai*) as well as the idea of increasing importance of knowledge in the development of a post-industrial society had been introduced respectively in Japan and in the US by the early 1960s. But it was not until the early 1970s, when a growing need to find new ways to improve national competitiveness and the new reports commissioned by the Japanese government about the forthcoming social impacts of computerisation inspired the

first wave of the information society debate. National planning for technology development started in the advanced capitalist societies following the Japanese example, and one of the most influential results of this work in Europe was *L'Informatisation de la société* (1978) by Simon Nora and Alain Minc. They introduced a whole new concept of *telematics* to describe the increasing interconnection of computing and telecommunications. Based on the report, the French government launched a development project for Minitel, the first online videotext service, which was introduced in 1982 (Nevalainen 1999: 7–8, Huuhtanen 2001: 4–6, 34, Karvalics 2008: 29–32). It is perhaps not very surprising that broadcasting was not yet in any central role in these early European visions of an information society (Garnham 1996: 107–108).

However, by that point, the broadcasting sector had also become a target of neoliberalist, market-driven reforms reducing the earlier government control and regulatory power of the political system. The deregulation of broadcasting actually started in the late 1970s when private radio was first introduced in the UK and in Italy, while the Carter administration in the US repealed several radio and broadcast regulations. This was further intensified in the US after the Reagan administration took over and the new chair of the Federal Communications Commission (FCC), Mark S. Fowler, started to replace regulatory practices in broadcasting with market-oriented solutions (Ala-Fossi 2005: 104–105). In most Western European countries, the long era of national public broadcasting monopolies came to an end, and the remaining radio monopolies throughout Europe fell by the end of the 1980s. Thanks to regulatory reform, the availability of the free FM spectrum and new, relatively inexpensive FM radio equipment, the number of new private stations exploded so that, by the early 1990s, there were already about 4000 local and regional radio stations in Europe (Vittet-Philippe and Crookes 1985: 8–10, Wedell and Crookes 1991: 9–21, Humphreys 1996: 111, 125–128).

But even a significant reduction of political regulation of electronic communications was not enough for some advocates for neoliberalism

like Peter Jay in the UK, who suggested in 1981 that the development of technology would soon remove grounds for any government interference for 'electronic publishing' (Jay 2005 [1981]: 79–88, Garnham 1982: 285–286). In this political context, a like-minded media theorist at the Massachusetts Institute of Technology (MIT), Ithiel de Sola Pool, formulated an argument for further deregulation of all media based on technological change. According to de Sola Pool (1983), new electronic technology was bringing all forms of media together into 'one grand system', and because this *convergence of modes* was making the historically developed, media-specific regulation of US communications systems obsolete, this potentially harmful practice should be completely abandoned (de Sola Pool 1983: 7–8, 28, Aufderheide 1999: 23, Comor 1999: 1056, Briggs and Burke 2005: 210). So, convergence as a force merging all media was already in the beginning an ideological interpretation of the consequences of technological development and a political tool rather than a solid theoretical concept, and its value for analysis (Fagerjord and Storsul 2007: 29) has not increased over the years (see also Herkman in this volume).

After the European opposition had prevented the adoption of the NHK system as the worldwide HDTV standard in 1986, the US government agencies and electronic industry reconsidered their strategies and set up new initiatives for domestic HDTV technology research. In 1987, the FCC started to look for industry proposals of a backwards compatible analogue HDTV, which would provide a reduced quality picture to all standard TV receivers while delivering HD to new, advanced receivers. Within the US broadcast industry, fully digital television was seen as an impossible goal, although several MIT professors continued urging for digital solutions and the complete integration of computers into television sets (Neuman 1988, Brinkley 1998: 93–95, Neil 2010). After a small San Diego division of General Instruments (GI), VideoCipher, made a breakthrough in developing an all-digital HDTV system in early 1990, the FCC and the US industry switched their approach from analogue to digital. GI soon allied with MIT in order to develop a computer-compatible digital

HDTV system with progressive image scanning – and suddenly, the US had taken the lead in the race for the future of television. By May 1993, seven developers from four rivalling American digital systems joined forces in the Digital HDTV Grand Alliance (Brinkley 1998: 120–134, Galperin 2004: 74–78, Alvarez et al. 1999: 6–10, Negroponte 1995: 37–40).

Meanwhile in Europe, the HD-MAC system was in trouble despite its intergovernmental support and the deep involvement of the European Commission courtesy of a special mandating directive. The analogue technology was expensive, prone to interference, required a broad spectrum and was not appealing for the increasing number of private broadcasters. The first unofficial studies for digital television systems in Europe were started in 1991, quite soon after receiving the news from the US. In the Olympic year of 1992, HD-MAC was not a success, even in the consumer markets as it had originally been planned, but the European Commission was still ready to pour in more money and a new directive in order to save the project. However, the British government strongly opposed these plans, and after Martin Bangemann became responsible for the European technology policies in the new Commission of 1993, the EU finally abandoned analogue HDTV and launched a new industry–led project for Digital Video Broadcasting (DVB) in Europe (Galperin 2004: 132–134, Näränen 2006: 42–43, Kemppainen 2008: 32–35).

According to Galperin (2004), the failure of the HD-MAC system was an important turning point both for European broadcasting policies and technology initiatives in general. Because an alliance of national governments, public broadcasters and major manufacturers together with the European Commission had not been able to make a migration to HDTV happen, it was obvious that a new approach was needed. On the European level, the neomercantilist high-tech rivalry of the previous decade was replaced with more market-driven, neoliberal policies drafted in the Bangemann report (EC 1994), promoting less intergovernmental arrangements with national champions over increasingly complicated broadcasting markets and more reliance on

private standards development (Galperin 2004: 133–135, Michalis 2007: 149–151). On the industry level, the failure of HD-MAC was also seen as a result of being a technology-led project, indicating a need for a more consumer-driven approach (Fagan 1994). Finally, it also made the Commission reluctant to openly support any single technology, and a few years later led to the adoption of the principle of *technological neutrality* (Lembke 2002: 227, 240).

Digital television as a strategic supplement

Despite the dramatic transition of broadcasting policies, regulatory practices and even industry structures of European radio broadcasting, changes did not happen overnight. In some European countries like France and Italy, public service radio had lost its leading position to smaller private stations very rapidly. However, in the UK and Germany, public service broadcasters BBC and ARD still dominated their domestic radio broadcasting markets in 1991 (Vittet-Philippe and Crookes 1985: 67, Wedell and Crookes 1991: 21–35, 182–200, Humphreys 1996: 159–199). In addition, the voices of new private and commercial radio broadcasters were not heard on the European level until the establishment of the Association of European Radios (AER) in 1992 and its emergence into political activity by the mid-1990s (Lembke 2002: 219–220). It is no wonder that the DAB development remained firmly in the hands of public service broadcasters and electronics manufacturers, while no private radio broadcasters were involved in either of the two phases of Eureka 147, the project developing DAB digital radio in 1987–1991 and 1992–1994 (Rissanen 1993).

The new DAB digital radio system was thought to be superior over analogue radio systems by not only improving but expanding radio: it was able to deliver several programmes for mobile reception with high-quality audio and additional services (but no video) using only a single transmitter. However, using *multiplexing* for delivering

several programme channels at the same time through one transmitting channel and the *Single Frequency Network* (SFN) for occupying only a single frequency in the available spectrum (Hoeg and Lauterbach 2003), which made sense for public service broadcasters in large-scale nationwide and regional broadcasting, were rather ill-fitted for local and small-scale broadcasters in the increasingly complex radio landscape of the 1990s. The first warning signal came when the US radio industry decided to develop its own digital radio system based on the existing frequency allocations despite the National Association of Broadcasters (NAB) giving an initial endorsement of DAB in 1991. The European system design reflected the old power structures of the European public broadcasting system, and it was considered to be too risky for the economic stability of American radio markets (Ala-Fossi and Stavitsky 2003: 62–67, 74). The serious mismatch between DAB and local radio was also pointed out in a report for the Council of Europe (Gronow et al. 1992) two years before DAB was formally recognised as an official standard for digital radio at the end of 1994, but no changes were made – and even the European spectrum allocations for digital radio in Wiesbaden 1995 were tailored for national and regional broadcasting.

The early 1990s were also a turning point for wireless telecommunication, especially mobile cellular telephony. The first commercially deployed digital mobile telephone system was the European GSM standard, which soon became very successful. Within 10 years after the first commercial GSM call was made in Finland in 1991, the system had 500 million subscribers worldwide (GSM World 2011). The development of computer technologies, which later became the basis for the Internet, had started in the US in the mid-1960s, but during the 1970s and 1980s, these new technologies did not yet have any implications for broadcasting. Actually, the Internet began to have serious effects on traditional media only after the introduction of the World Wide Web in 1992 and the first web browser in 1993 (Henten and Tadayoni 2008: 49–51).

All this happened at the same time as the second coming of the information society agenda, which was primarily inspired by the US National Information Infrastructure (NII) initiative, officially launched by the newly elected Clinton administration in September 1993. The vision about the 'information superhighway' was largely based on the ideas of the development of computer technology and the Internet, but the American concept of digital TV was also identified from the very beginning as an essential part of the new US government strategy. In a society where more households had television sets than telephones or personal computers, it was expected that a new interactive form of digital television could provide a more natural gateway to the information society (Huuhtanen 2001: 24, Aufderheide 1999: 43, Galperin 2004: 37–39, Negroponte 1995: 42–43, 54). A group of MIT academics and the US computer industry, most notably Apple Computers, had been persistently promoting the compatibility of the new US digital television standard with the existing computer technology, so the NII and the new agenda inspired by it matched with the earlier visions of the electronic convergence of all media (Hart 2004: 155, 165, Neil 2010). However, US broadcasters were reluctant to abandon their traditional interlaced display formats, so the preconditions for digital convergence did not exist until the Advanced Television Systems Committee (ATSC) standard was approved by the FCC in December 1996 (Brinkley 1998: 393).

In order to protect the competitiveness of its own member states, the European Union reacted rapidly to the NII initiative, and in December 1993, the Delors White Paper suggested a large development programme for telecommunications, computer networks and other information infrastructure in Europe. The European Council warmly supported the ideas and asked for an implementation plan, which was then prepared under Commissioner Martin Bangemann. While the information society hype took over broadcasting in the audiovisual Green Paper of 1994, a few months later the Bangemann report more or less adapted the American NII programme for the European Community and gave a series of recommendations for the member states

on how to pursue the information society. In addition, the report also included the development of digital television (interactive video) into the European action plan (Michalis 2007: 164–165, Galperin 2004: 39–40, 134–135). Interestingly, digital radio was not even mentioned in the Bangemann report (1994) although it already existed, unlike digital television; even in the European Green Paper on Convergence (1997), there is only one reference made to multimedia digital radio (EC 1994, EC 1997: 5).

As already noted, by the time the DVB project for European digital television began in September 1993, DAB was almost completed as the standard for digital radio with narrowband channels and no video codec. It was thought to be superior new European digital technology for audio broadcasting, so instead of any re-evaluation or reform of the nearly finished system, it made more sense to supplement it with an equally superior digital system for video broadcasting. On the other hand, it was also reasonable to utilise all the existing European research on digital broadcasting for digital television development. This is why DVB digital television has many technical similarities to DAB digital radio, including multiplexing and SFN, and in certain conditions 'DVB-T is effectively a wide bandwidth version of the DAB system' (Laven 1998: 5–6). However, these two closely related European digital broadcasting systems were also intentionally made incompatible with each other.

There was no particular desire in Europe to merge the new digital broadcast systems despite the increasing popularity of the idea of convergence and the awareness of the Japanese concept of ISDB. The national public broadcasters still had strong and strictly separate radio and television organisations with their own distinctive development strategies, and the members of the EBU considered the two digital systems mostly as independent digital replacements of the two analogue broadcasting systems. In addition, the new consumer-driven approach led the DVB developers to aim at what the majority of consumers were expecting from television. Instead of very high quality pictures, DVB offered more channels to provide more choice (Fagan 1994),

and because most people were not watching television on the move, DVB (-T) was designed for fixed roof-top antenna reception of video on wideband channels, while mobile reception capability was ignored on purpose (Yamada 2006: 28). So, when DVB was approved as an official standard in 1995, it was intentionally inappropriate for mobile use and rather uneconomic for any radio-type services (Baumgartner 2005: 1–2, Wood 1995, Wood 2001: 2, Laven 1998: 5–6).

Converging vs. competing digital broadcasting systems

In Japan, abandoning analogue Hi-Vision after investing money and effort in it for over 20 years was a very difficult process. Although NHK laboratories set up a whole new department for research on digital broadcasting methods in 1991 (Yamada 2006: 32), by 1994 most Japanese politicians and industry leaders were officially still backing analogue HDTV (Fagan 1994, Negroponte 1995: 37–40, Hart 2004: 199–203). The head of the new NHK digital broadcasting research department, Osamu Yamada, had become interested in OFDM and the European DAB project in the late 1980s because of its capability to provide robust mobile reception. After he discovered in 1992 that both the Europeans and the Americans had intentionally left mobile reception outside of their respective standard specifications for digital television, mobile reception using OFDM was made one of the cornerstones of the new Japanese digital broadcasting system (Yamada 2006: 28).

Another new competitive advantage was found in Japan from the earlier concept of ISDB by developing the new system as an integrated digital platform instead of the media-specific approach adopted both in Europe and the US. By utilising already existing research on digital broadcasting, the Japanese were able to introduce the technical specifications of their new digital broadcasting system in 1997. ISDB-T has several technical commonalities with both DAB and DVB, but

thanks to its convergent technological approach on digital broadcasting, it was able to offer mobile reception of both radio and television in standard quality as well as in HD format, unlike its European relatives (Yokohata 2007: 1, Nakahara 2003: 5, 27, 30–33, Miyazawa 2004: 6, 26, Kim 2003). In this way, it was able to challenge the conventional conceptions of both broadcast television and radio.

The ISDB approach was possible mainly because radio and television were not treated as completely separate entities with unique identities, but rather as two forms of broadcast media based on different degrees of technical complexity. From the Japanese perspective, radio was also in every way a minor and subordinate media when compared to television (Kato 1998: 177), and there was no demand for another separate DAB-type system for digital radio, either. However, this integrated digital platform blurring the traditional boundaries between radio and television seems to be rather a common ground for both new and old types of broadcast media than a basis for a single converged medium in itself.

By the end of the 1990s, it had become obvious that the European strategy of creating two complementary digital broadcasting systems had resulted in a situation where DAB was in fact competing with DVB over political and industrial support in Europe. Some people were so impressed by DVB that they proposed it for all digital broadcasting. The EBU was able to defend DAB by pointing out that because the systems were designed to be complementary, they could not possibly substitute each other (Laven 1998, Wood 2001). The former head of the EBU technical department, David Wood, even stated that 'ultimately, radio is likely to survive and prosper better in the digital age, if it is the master of its own environment' (Wood 2001: 3). However, the odds turned against DAB partly for the same reasons, which, according to Galperin (2004: 25–27), supported the rapid implementation of terrestrial DVB and causing the *digital TV paradox*: 1) DAB and DVB were both results of a pan-European project for saving the electronics industry in Europe, but digital radio was always more like a by-product than the actual centrepiece of the European high-tech

counterattack. This is quite understandable considering the smaller economic and political importance of radio. Its increasingly fragmented markets did not help much in its competition for support with DVB, either. 2) While digital (interactive) television was seen as an ideal way to overcome the *digital divide* and bring the information superhighway to every home, digital radio was hardly even mentioned in the most influential visions of the new information society, just as there would not be any primarily audio-oriented communication in the future. 3) Migration to DVB was going to create significant a *digital dividend* for rapidly growing mobile telephony services by packing television broadcasting into smaller space in the radio spectrum, while it simultaneously provided more channels for television. Although full-scale migration to DAB could have also created some vacant spectrum in the long run, the relative benefit per channel was going to be much smaller, and the telecom industry was not very interested in taking over the FM band, where a rather wide selection of radio channels in most cases already existed in the late 1990s. In addition, the recently adopted technological neutrality principle provided a politically correct excuse for 'letting the market decide'.

These issues made EU institutions and most European governments pushing DVB not give much ideological, legal or political support for DAB by the turn of the century despite the joint efforts of AER, EBU, WorldDAB Forum and the European Association of Consumer Electronics Manufacturers (EACEM) (Lembke 2002: 212–240). For example, in Finland, when the formal decision about digitalisation of all broadcasting was made by the Council of State in May 1996, DAB radio was expected to make its breakthrough in the consumer markets many years before DVB television, which required much larger investments (Mykkänen 1995: 20–22). However, within three years, it became clear that both the stakes and rewards for successful migration to digital television were much higher, while the implementation of digital radio was in practice much more difficult than originally expected. Nokia abandoned DAB in 1997, and two years later, the Finnish government as well as most of the broadcast industry

concentrated their efforts on supporting the implementation of DVB (Heikkilä 1999: 9, Lax et al. 2008: 156–157, Ala-Fossi 2011).

By 1998, the increasing importance of the Internet as a converged digital media platform and the first ISDB field trials with mobile TV experiments in Japan made European developers of digital television understand that digital broadcasting could offer more than just traditional media concepts – and that they actually may have made a strategic mistake by excluding mobile reception from the DVB standard. The very first prototype of a European mobile TV receiver was quickly put together at Nokia's DVB unit in Turku, Finland. Nokia also participated in setting up a new EU-supported project (AC318 Motivate) to develop a European system for mobile television and to compete against ISDB (Kemppainen 2008: 23, Torikka 2007, Motivate 1998, Talmola 2005: 2).

As noted earlier, the DVB system was based on an assumption that the receivers would always have a mains connection and a rooftop antenna, so their power consumption was quite high, and mobile reception was unreliable (Torikka 2007, Högmander 2003). The Nokia Turku unit solved these problems by dividing the signal into short bursts and slightly reducing the picture quality (Torikka 2007, Vihma 2007, Lehto 2006), but after these modifications, it was not possible to receive any regular DVB broadcasts with a handheld DVB-H receiver or vice versa (Ala-Fossi 2010: 52–56).

Despite this incompatibility, the new modified version of DVB standard was considered to be a brilliant piece of European engineering, and the DVB-H project team of Nokia even received the Finnish Engineering Award in 2007. Later in the same year, the European Commission took a stand in favour of DVB-H and a year later added it to the EU List of Official Standards (Torikka 2007, EC 2007, EU 2008). For a while, both the government and industry expectations over the success of the new European mobile television system as a converged broadcast platform for digital radio and mobile multimedia were very high, but the failure of DVB-H is now unquestionable. In 2011, Finland and Italy were the last remaining countries in Europe

with commercial DVB-H services (de Renesse 2011). By March 2012, DVB-H services in Finland will be replaced with services based on another new version of digital television, DVB-T2 (MINTC 2011, Digita 2011).

Digital convergence of broadcasting in Europe – an opportunity lost?

The development and history of digital broadcasting technologies is obviously a complex series of intermedial and international relationships rather than a straightforward process towards digital consolidation. European digital radio would not have been like DAB without the Euro-Japanese project to create the CD, the European pre-development of digital radio and audio systems and the Japanese HDTV proposal, which together set separate paths for the European development of television and radio. In addition, European television would not be digital without the American impact – and it would not be like DVB without the indirect and direct influence and sheer existence of the DAB system. The European systems were both, in turn, starting points for the Japanese development of ISDB, which was designed to provide mobility unlike Western television systems. Additionally, the ISDB system provided the reason for the development of the new European antidote called DVB-H.

Digitalisation *per se* does not necessarily lead to any kind of integration of different forms of media, but it can be one of the preconditions for implementing an expansive convergence business strategy based on removing earlier technological, regulatory, political and legal barriers between existing markets. This neoliberal approach has been supported by technologically deterministic and circular argumentation: because technology was driving convergence, policies had to be changed and regulations removed, which in turn would increase and accelerate the economic process, making convergence function like a

'self-fulfilling prophecy' (Hesmondhalgh 2007: 135). However, technologies are never the real driving force behind any policy changes, but socially shaped tools for certain socially defined practices, while their capacities and characteristics effectively set the limits for the political and economic goals of their use. The original idea of digital media convergence was based on a mistaken assumption that these limits would simply vanish or become indifferent through digitalisation. After it gained enough popularity and political importance, the gates for new and expanding digital business activities were opened through policy reforms.

The European project for digitalisation of broadcasting has actually not failed in increasing digital media convergence because that was not even its original goal. As long as the digital television system was considered to be impossible to design, the idea of convergence did not have much impact on the development of broadcasting technologies. On the contrary, the fundamental economic motives of European media technology projects were to protect European markets and industries by creating new technological barriers. However, this setting changed dramatically when the unexpected breakthrough in digital television development and simultaneous difficulties in the analogue HDTV project made European politicians re-evaluate their high-technology policies and adopt a more neoliberal approach. Convergence, especially the integration of television and computer, was now one of the promises of the new digital future, which would create new commercial markets and smooth the way towards the brave new information society. The brand new interactive digital television supplementing telecom and computing services seemed to be a perfect way to both avoid the *digital divide* and create more *digital dividend*, while digital radio fighting for the same resources and support was already on the road towards political and economic marginalisation.

The most crucial decisions leading into digital divergence of terrestrial broadcasting in Europe were made in the early 1990s, when the DVB specifications were drafted. Another mobile digital broadcasting system would have been a direct threat to the DAB system still in its

infancy, and there was no evidence that European consumers would appreciate mobile reception of television. Finally, there were strong cultural, economic and organisational forces inside the national public broadcasting companies maintaining separate spheres for both broadcast mediums. Together, these factors led to the development of DVB, which in practice excluded the possibility for digital convergence of all broadcasting in Europe. This was not a problem for EBU members as long as they considered themselves primarily radio and television broadcasters, but it has not really fit together with the business strategies of commercial broadcasting or the new, more convergence-oriented digital strategy of Public Service Media adopted in the 2000s (EBU 2002: 17, Bardoel and Lowe 2007).

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